INEEL Geocentrifuge Research Laboratory

Idaho National Engineering and Environmental Laboratory

Home of Science and Engineering Solutions

The Geocentrifuge Research Laboratory at the Department of Energy's Idaho National Engineering and Environmental Laboratory was established to provide important environmental, geotechnical, nuclear, and national defense research for the nation.

The centerpiece of the facility is a 2-m geocentrifuge. The centrifuge has a 50 g-ton capacity, and is capable of spinning a sample as large as 70 cm long by 50 cm thick by 60 cm high.

INEEL model C-61 geotechnical centrifuge system (50-g ton, 2-m radius).

The geocentrifuge subjects a sample to a high-gravity field by spinning it rapidly around a central shaft. When the geocentrifuge is spinning at 260 revolutions per minute, it is capable of applying up to 130 times the force of earth's gravity on an experimental sample.

In this centrifugal field, fluid flow occurs much more rapidly than under 1 gravity. Thus, by using the geocentrifuge technique, researchers can study the effects of tens of years of gravity-induced fluid movement in a few days or weeks.

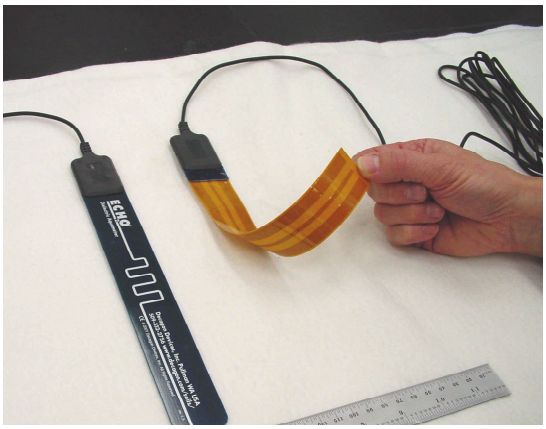
The geocentrifuge is constructed with an asymmetrical beam arm and pendulum swinging basket that rotates within a steel and concrete enclosure, ensuring both safety and aerodynamic efficiency during operation. An automatic balancing system automatically compensates for changes in the center mass during operation, a feature that is particularly useful in many environmental geocentrifuge applications involving fluid movement.

INEEL researchers use the geocentrifuge to perform work such as:

- Evaluating engineered caps and barriers
- Conducting unsaturated flow and transport experiments
- Improving characterization of contaminated sites
- Testing new geophysical tools.

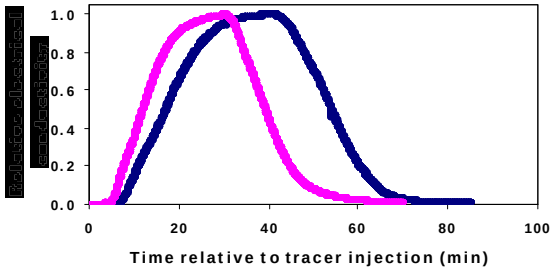
New tools are being developed to conduct accelerated research experiments in the INEEL geocentrifuge. Not only must these tools collect information more rapidly than traditional

laboratory experiments, they also must withstand high centrifugal force while the geocentrifuge is spinning. Tool designs to monitor experiments while they are in flight include new moisture content sensors, modified soil testing columns, fluid sampling apparatus, and geophysical tomographic techniques.



New flexible moisture content probe design.

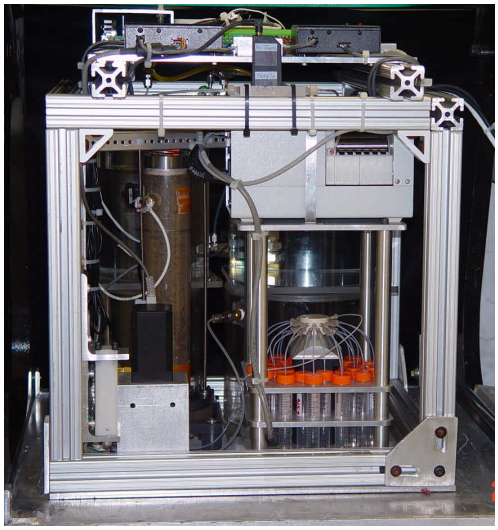
Experimental control and monitoring are accomplished by using the on-board computer. This ability allows for greater density of data collection and experimental control of geocentrifuge tests than smaller centrifuges allow. Data transmission from the geocentrifuge occurs in real time, allowing the researchers to evaluate the results of their experiments while tests are in progress.



Example of breakthrough curves from geocentrifuge experiments.

New numerical models have been developed with university collaborators to analyze experimental data from the geocentrifuge. These models include modified versions of HYDRUS 1- and -2D that account for the applied centrifugal force. The models are used to both design geocentrifuge experiments and to estimate parameters from outflow and tracer experiments.

The Geocentrifuge Research Laboratory is available for use by outside scientists, allowing personnel from other institutions and laboratories to perform research to test their scientific and engineering hypotheses. Outside researchers are encouraged to contact INEEL scientists for collaboration opportunities using the facility.



Experimental setup using the INEEL geocentrifuge.

For more information about the INEEL Geocentrifuge Research Laboratory, visit our web site at:

www.inel.gov/env-energyscience/centrifuge

Contacts:

Earl D. Mattson, Ph.D.
Lead Researcher
(208) 526-4084
matted@inel.gov

Mark D. Ankeny, Ph.D.
Manager, Geosciences Research
(208) 526-5748
ankemd@inel.gov